

Bucknell UNIVERSITY

2009-10 Catalog

College of Arts and Sciences

Biology (BIOL)

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Biology is the natural science that concerns itself with study of the living world. The faculty of the biology department approaches the principles of the science from the unifying perspective of the theory of evolution. Emphases include both the theory and practice of the way scientific investigations are conducted as well as the more practical applications of biology.

A major in biology may serve as a sound preparation for those interested in careers in the life sciences including those who go on to graduate or medical school. Majoring in biology also adds to students' understanding of the issues concerned with health, the environment, and agriculture. In addition, Bucknell's biology majors are given the opportunity to become broadly educated "whole" scientists. They are encouraged to explore their interests within the humanities and social sciences.

Two degree programs are offered through the biology program.

The **bachelor of arts major** requires eight courses in biology: the core sequence of BIOL 205, BIOL 206, BIOL 207, BIOL 208, which must be completed by the end of the third year, and four 300-level or above electives. (Only one of the four electives can be BIOL 399, but additional BIOL 399 credit may be applied as electives beyond the courses offered for the major). At least one of the four electives must be in each of the following three areas (I – Cellular/Molecular; II – Organismal; III – Ecological/Evolutionary) listed below, and two of these courses from different areas must be a laboratory or field course.

Area I – Cellular/Molecular: BIOL 302 Microbiology, BIOL 322 Physiological Mechanisms, BIOL 323 Mammalian Histology, BIOL 324 Neurophysiology, BIOL 326 Cytogenetics, BIOL 327 Molecular Biology, BIOL 328 Endocrinology, BIOL 331 Functional Genomics, BIOL 340 Biochemical Methods, BIOL 343 Neural Plasticity, BIOL 347 Virology, BIOL 348 Immunology, BIOL 352 Cell Biology, BIOL 365 Introduction to Microscopy

Area II – Organismal: BIOL 303 Behavioral Neuroendocrinology, BIOL 312 Vertebrate Anatomy, BIOL 313 Mammalogy, BIOL 316 Plant Growth and Development, BIOL 318 Comparative Physiology, BIOL 339 Developmental Biology, BIOL 342 Neuroethology, BIOL 346 Environmental Physiology, BIOL 357 Ornithology, BIOL 358 Invertebrate Biology, BIOL 359 General Entomology

Area III – Ecological/Evolutionary: BIOL 315 Natural History of Vertebrates, BIOL 321 Behavioral Ecology, BIOL 330 Plant Systematics, BIOL 334 Limnology, BIOL 341 Organic Evolution, BIOL 353 Ecosystem Ecology, BIOL 354 Tropical Ecology, BIOL 355 Social Insects, BIOL 356 Plant-Animal Interactions, BIOL 361 Systematic Biology, BIOL 370 Primate Behavior and Ecology, BIOL 415 Conservation Biology

The biology major under the bachelor of arts degree also requires one year of organic chemistry, CHEM 211-212, which must be completed by the end of the sophomore year, and one year of mathematics, MATH 201 (calculus) and MATH 216 (applied statistics).

The **bachelor of science major** requires nine courses in biology. The major provisions in biology are the same as those noted above under the bachelor of arts major, but five rather than four 300-level electives are required, only one of which can be BIOL 399.

The bachelor of science major also requires: organic chemistry, CHEM 211-212, which must be completed during the first year, one year of mathematics, MATH 201 (calculus I) and MATH 216 (applied statistics), and one year of physics (PHYS 211-212). Two additional courses in major-related areas are also required. Any two of the following courses will satisfy the requirements: CHEM 221, CHEM 231, CHEM 340, CHEM 351, CHEM 352; CSCI 203, CSCI 204; GEOL 103, GEOL 104, GEOL 106, GEOL 205, GEOL 213, GEOL 305, GEOL 310; MATH 202, MATH 211, MATH 217; PHIL 220, PHIL 272; PHYS 221; PSYC 250, PSYC 349; ANBE/BIOL/PSYC 266. Other courses may be substituted with department approval.

Students interested in behavioral aspects of biology may wish to consider the animal behavior major (pg. 15); those interested in biochemistry, the cell biology/biochemistry major (pg. 24); those interested in environmental issues, the environmental studies program (pg. 48), and those interested in neural biology, the neuroscience program (pg. 90). Students planning to continue with graduate training in biology are encouraged to elect MATH 217 Statistics II and/or MATH 202 Calculus II and to consult their academic adviser or pre-health professions adviser.

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The recommended sequence for the bachelor of science major is as follows:

First Year	First Semester: BIOL 205; CHEM 211; MATH 201; Foundation Seminar Second Semester: BIOL 206; CHEM 212; MATH 216
Sophomore Year	First Semester: BIOL 207; Related area course Second Semester: BIOL 208; Related area course
Junior Year	First Semester: Elective in biology; PHYS 211 Second Semester: Elective in biology; PHYS 212
Senior Year	First Semester: Two electives in biology Second Semester: Elective in biology

Transfer students must complete at least four courses in biology in residence at Bucknell, only one of which may be BIOL 399.

For Bucknell students who elect to study abroad, at least three upper division courses toward the major and at least one toward the minor must be taught by Bucknell faculty.

Students who pass BIOL 121-122 and wish to major in biology may receive one core credit pending consultation with the department.

A **minor** in biology consists of five courses. Two of the five courses must be selected from among the following introductory level courses: BIOL 121, BIOL 122, BIOL 205, BIOL 206, BIOL 207, and BIOL 208. At least two of the courses must be 300-level courses, exclusive of BIOL 399.

Asterisks (*) indicate courses in which animal dissection **OR** experimentation with living animals may be involved in the laboratory.

111. Controversies in Biology (I; 3, 3)

Introduction for the non-science major. Background on molecules, cells, and genetics. Required discussions about current advances and controversies in biology. Not for pre-health students. Will not count toward the biology major. Students who take BIOL 111 may not take BIOL 121.

121 and 122. General Biology (I and II; 3, 3*)

Introductory courses primarily for the non-biology major. BIOL 121 focuses on life at the cellular and biochemical levels, genetics, and plant biology. The topics covered in BIOL 122 include principles of ecology and evolution, and animal diversity, behavior, structure, and function. It is not necessary to take BIOL 121 prior to taking BIOL 122.

150. Plants, People, and the Environment (AI; 3, 3)

The diversity and evolution of plants, fungi, and related organisms with special emphasis on flowering plants; their importance for food, fiber, medicine, and psychoactive compounds; origins of agriculture; domestication of plants; and the role of plants in the environment. No prerequisite required. Meets Lab Science requirement.

151. Regional Agriculture and French Society (I or II; 3, 3)

This biology lab course will treat the political, social, and scientific importance in France of “produits du terroir” (local agricultural products) to daily life and personal identity. Prerequisite: Open only to student enrolled in the Bucknell *en France* program.

205. Introduction to Molecules and Cells (I; 3, 3)

An introductory course which focuses on the molecular biology of cells. Basic biochemical processes, cellular and subcellular structure and function are emphasized. First core course.

206. Organismal Biology (II; 3, 3*)

An introductory course for biology majors emphasizing organisms as dynamic systems by integrating structure with function. Laboratories introduce scientific method and collaborative learning. Second core course. BIOL 205 is strongly recommended as a prerequisite.

207. Genetics (I; 3, 3)

A comprehensive survey of genetic mechanisms and methodologies, including classical genetics, recombinational analysis in bacterial, fungi, and higher eukaryotes, molecular genetics and populational and quantitative genetics. Third core course. Prerequisite: BIOL 205.

208. Population and Community Biology (II; 3, 3)

Introduction to systematic biology, evolutionary theory, physiological ecology, behavioral ecology, population and community ecology, and ecosystem structure and function. Fourth core course. Prerequisite: a general biology course or BIOL 207.

220. Human Anatomy (I; 3, 3*)

A course that focuses on the anatomy of and relationship between human muscles, bones, and organs. Lab involves dissection, with the cat as the primary specimen. Does not count towards the biology major.

221. Human Physiology (II; 3, 3)

A course that focuses on the functions of and interactions between human organ systems. Does not count towards the biology major.

245. Tropical Marine Biology (S; 5, 15)

A field course in marine biology of coral reefs in the Virgin Islands for non-science majors. Prerequisite: permission of the instructor.

266. Animal Behavior (I; 3, 0)

A survey of important theories, issues, and empirical techniques in the interdisciplinary field of animal behavior emphasizing both proximate and ultimate mechanisms and explanations for behavior. Crosslisted as ANBE 266 and PSYC 266.

298. Stream Restoration (II; R; 3, 4)

Scientific principles to integrate physical and biological approaches to stream restoration in watershed management. Team-taught field course highlights developing restoration plan for Bucknell's Miller Run. Crosslisted as ENST 298, GEOL 298, UNIV 298.

299. Watershed Systems Science (I; R; 3, 4)

Watersheds regulate water flow and ecosystem health on our landscape. Team-taught field course integrating physical, chemical, and biological processes in watersheds, using the Susquehanna and tributaries. Crosslisted as ENST 299, GEOL 299, UNIV 299.

302. Microbiology (II; 3, 3)

Ultra-structure, behavior, metabolism, molecular biology, and development of micro-organisms. Roles in disease and food production. Laboratory will emphasize cultivation and identification. Prerequisites: BIOL 205, BIOL 207, and permission of the instructor.

303. Behavioral Neuroendocrinology (AI; 3, 0)

Relationship between the neuroendocrine system and animal behavior, including human behavior; incorporating and integrating evolutionary, developmental, and clinical perspectives. Prerequisites: BIOL 206 and permission of the instructor.

312. Comparative Vertebrate Anatomy (I; 3, 3*)

Gross morphology with emphasis on functional and evolutionary modifications of animal structure. Gross dissection and techniques used in morphology. Prerequisites: BIOL 122 or BIOL 206 and permission of the instructor.

313. Mammalogy (AI; 3, 3*)

Biology of mammals, including evolution, classification, biodiversity, behavior, anatomy, physiology, ecology, and conservation. Lab will include specimen identification, preparation, and field study. Prerequisites: BIOL 206 and permission of the instructor.

316. Plant Growth and Development (AI; 3, 3)

The physiological and molecular bases of growth and development at the organ, tissue, and cellular levels. Effects of environmental stimuli and hormones on gene expression and the resultant changes at higher levels of organization. Prerequisites: BIOL 205, BIOL 206, and permission of the instructor.

318. Comparative Physiology (I or II; 3, 3 or 0)

Compares the physiological mechanisms of animals, both invertebrate and vertebrate, from the standpoint of their evolutionary history and ecology. Prerequisites: BIOL 206 and permission of the instructor.

319 and 320. Seminar (I or II; R; 3, 0)**321. Behavioral Ecology (II; 3, 0)**

The consideration of behavioral adaptations to various ecological situations. Topics include habitat choice, foraging behavior, defenses against predation, mate choice, and brood care. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as ANBE 321.

323. Mammalian Histology (II; 3, 3)

A detailed study of the microscopic architecture and associated physiology of mammalian cells, tissues and organ systems. Prerequisites: BIOL 205 and 206 and permission of the instructor.

324. Neurophysiology (I; 3, 0)

A study of neural signaling via stimulus-response, with an emphasis on cellular integration. Sensory-motor as well as more complex brain systems will be explored. Prerequisites: BIOL 205 and 206 and permission of the instructor.

326. Cytogenetics (II, 3, 3)

Study of chromosome structure, organization, aberrations, and behavior. Multiple eukaryotic systems will be considered, with links to human disease. Prerequisites: BIOL 205 and BIOL 207 and permission of the instructor.

327. Molecular Biology (I and/or II; 3, 3)

Synthesis of DNA, RNA, and protein, and the regulation of these processes both prokaryotic and eukaryotic cells; laboratory experience in the manipulation and analysis of genes. Prerequisite: BIOL 205 and BIOL 207 and permission of the instructor.

328. Endocrinology (I; 3, 3*)

Regulation and function of hormones and their receptors from molecular to organismal levels. Role of hormones in development, physiology, and behavior; endocrine disease. Prerequisites: BIOL 205 and BIOL 206 and permission of the instructor.

334. Limnology (I; 3, 3)

The physical, chemical, and biological characteristics of freshwater communities are studied. Prerequisites: BIOL 208 and permission of the instructor.

337. Biology of Aging (I; 3, 0)

This course will explore questions in the biology of aging from a physiological, genetic, and evolutionary framework with an emphasis on critical reading of primary literature. Prerequisite: BIOL 206 and permission of the instructor.

339. Developmental Biology (II; 3, 3*)

Morphological, physiological, and biochemical aspects of cellular and embryonic development of animals. Emphasis on the molecular genetics of development. Prerequisites: BIOL 205, BIOL 206 and permission of the instructor.

340. Biochemical Methods (II; 2, 6)

A course in laboratory techniques including cell fractionation and analysis of proteins and nucleic acids. Spectrophotometry, chromatography, centrifugation, electrophoresis, and methods of molecular cloning are emphasized. Prerequisites: BIOL 205 and permission of the instructor. Crosslisted as CHEM 358.

341. Organic Evolution (II; 4, 0)

The principles and mechanisms of evolution in plants and animals, covering population phenomena, speciation, life history strategies, adaptation, systematics, and biogeography. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as ANBE 341.

342. Neuroethology (I or II; 3, 0)

A course that integrates neurobiology and behavior in natural contexts. Emphasis on signal detection, recognition, discrimination, localization, orientation, and the control of complex acts. Neuronal and hormonal mechanisms, ontogeny and evolution of behavior will be considered. Prerequisites: BIOL 206, BIOL 208, and permission of the instructor. Crosslisted as ANBE 342.

343. Neural Plasticity (I; 3, 0)

Brain structure and function, emphasizing cellular and molecular approaches to neural development, plasticity and degeneration. Prerequisites: PSYC 250 or BIOL 205 and permission of the instructor. Crosslisted as PSYC 343.

347. Virology (I or II; 3, 0)

The study of virus structure, genome organization, replication and host-interactions. Emphasis will be on animal and bacterial viruses. Prerequisites: BIOL 205, BIOL 207, and permission of the instructor.

348. Immunology (II; 3, 3*)

Development and function of the immune system in animals. The immune response in health and disease. Techniques in immunology. Prerequisites: BIOL 205, 206, and permission of the instructor.

349. Special Topics in Biology (I or II; 3, 0)

Topics vary. Prerequisite: permission of the instructor.

352. Cell Biology (I and/or II; 3, 3)

Covers biomembranes, cell growth patterns, cell signaling, the cytoskeleton, cell organelles, and microscopic technique. Laboratory includes experience with cell culture. Prerequisites: BIOL 205 and permission of the instructor.

353. Ecosystem Ecology (AI; 3, 0)

Interactions between organisms and physical and chemical environment including nutrient cycling and energy flow, global biogeochemistry, temporal and spatial dynamics of ecosystems. Prerequisites: BIOL 208, junior or senior status, and permission of the instructor.

354. Tropical Ecology (I or II; 3, 0)

Introduction to tropical ecology, including life history strategies of vertebrates and invertebrates, biodiversity management and conservation. Emphasis on class and individual projects, data collection, and journal keeping. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as ANBE 354.

355. Social Insects (I; 3, 3)

Evolution and genetics of social behavior, caste, communication in foraging and colony defense, queen and worker control over reproduction, social homeostasis, and population dynamics. Occasionally may be taught as a laboratory science. Prerequisites: BIOL 208 and permission of the instructor. Crosslisted as ANBE 355. Juniors and seniors only.

356. Plant-Animal Interaction (I; 3, 3)

The coevolution and ecology of plants and animals covering pollination ecology, seed dispersal, plant-herbivore interactions, and habitat constraints on the behavioral ecology of animals. Prerequisites: BIOL 122 or BIOL 208 and permission of the instructor. Crosslisted as ANBE 356.

357. Ornithology (II; 3, 3)

The biology of birds, including evolution, behavior, anatomy, physiology, ecology, and conservation; lab trips focus on identification of birds in the field. Prerequisites: BIOL 206 and BIOL 208 and permission of the instructor. Crosslisted as ANBE 357.

358. Invertebrate Zoology (AI; 3, 3)

A survey of the invertebrate phyla covering phylogenetic relationships, functional morphology, ecology, life histories, symbiosis, ontogeny, and behavior. Includes hands-on study of organisms in lab and field. Prerequisites: BIOL 206, BIOL 208, and permission of the instructor.

359. General Entomology (AI; 3, 3)

The biology of insects and their kin: anatomy, physiology, ecology, behavior, development, evolution, systematics, and diversity. Prerequisites: BIOL 206, BIOL 208, and permission of the instructor.

365. Introduction to Microscopy (II; 3, 3)

This course is designed as an overview of light and electron microscopy, with emphasis placed on the use of instrumentation. Prerequisite: BIOL 352 and permission of the instructor.

370. Primate Behavior and Ecology (I; 3, 3*)

Introduction to research on prosimians, monkeys, and apes, including diversity, social evolution, sexual selection, reproduction, social behavior, and cognitive abilities. Prerequisites: BIOL 122 or 208, or 266 and permission of the instructor. Crosslisted as ANBE/PSYC 370.

399. Undergraduate Research (I or II or S; R; 0, 6* or 12*)**Half to two courses.**

Open to qualified juniors and seniors with the permission of the instructor.

415. Conservation Biology (I or II; 3, 0)

A synthesis of topics relating to the conservation of plants and animals including extinction, genetics, demography, insularization, threats to biodiversity, conservation economics, environmental ethics, and strategies for conservationists. Prerequisites: BIOL 208 or BIOL 122 and permission of the instructor. Crosslisted as ANBE 415.

Courses offered occasionally: 209 Human Genetics, 211 Concepts in Biotechnology, 268 Behavior and Ecology of Birds and Mammals, 315 Natural History of Vertebrates, 322 Physiological Mechanisms, 330 Plant Systematics, 331 Functional Genomics, 346 Environmental Physiology, 361 Systematic Biology